

5611 Tech

U.S. DEPARTMENT OF COMMERCE

TECHNICAL NEWS BULLETIN

OF THE

NATIONAL BUREAU OF STANDARDS

ISSUED MONTHLY

Washington, May 1934.—No. 205

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NATIONAL BUREAU OF STANDARDS

The Secretary of Commerce announced in a memorandum dated April 27, 1934, that the name "National Bureau of Standards" will henceforth be used as the official designation of this Bureau.

The order restores to common use the name of the Bureau as set forth in the organic act passed by Congress March 3, 1901, which reads, "That the Office of Standard Weights and Measures shall hereafter be known as the National Bureau of Standards."

The use of the shorter title, "Bureau of Standards", has resulted in considerable confusion, because in recent years many of the State and municipal governments and several private organizations have established bureaus of standards. This confusion will be avoided by the use of the original legal designation.

A PROPELLER-VIBRATION INDICATOR

A very few of the many thousands of aircraft propellers in service fail in flight. The appearance of the fractured surfaces indicates that the failures are due to stresses imposed by vibration—that is, that they are

"fatigue" failures. Although not definitely proved, it is believed that the failures are in most cases to be accounted for by the occasional coincidence over relatively short periods of time of engine speed (or its multiples or submultiples) with a resonant frequency of the propeller or the propeller-engine assembly. If this is true, the failures may be avoided by not running the engine at certain critical speeds.

The Bureau has designed and constructed an instrument intended to be mounted on the propeller end of the engine shaft for determining these critical engine speeds. On the propeller vibrating apparatus at the Bureau, which makes possible the study of the stresses produced in propeller blades by vibrations of any frequency between 10 and 180 cycles per second, the instrument indicates clearly the presence of resonant vibrations when such vibrations are visually seen to be present.

Arrangements have been made to try the indicator on an airplane in cooperation with the National Advisory Committee for Aeronautics. A more detailed description is published in the May Journal of Research as RP678.

SIGNIFICANT VAPOR PRESSURE CONSIDERATIONS OF THE VAN SLYKE MANOMETRIC METHOD OF GAS ANALYSIS

The significance of vapor pressures in relation to the "*c correction*" of the Van Slyke manometric method of gas analysis is discussed in RP680 in the May number of the Journal of Research. It is shown that the *c correction* changes with temperature in such a way that the determination of one such correction for a particular apparatus (and procedure) is inadequate. The prescribed Van Slyke technique may introduce errors amounting to several tenths of 1 percent in cases where the accuracy claimed is several hundredths of 1 percent. Other vapor pressure considerations are discussed and possible errors pointed out. Two suggestions are offered to correct the difficulty, one of which involves a modification of the apparatus.

MEASURING THE AIR PERMEABILITY OF PAPER AND OTHER SHEET MATERIALS

A sensitive instrument has been developed at the Bureau for measuring the rate at which air passes through paper and porous materials in sheet form. The air permeability of paper is significant in a great many ways. Sheathing paper used in the walls of houses should be airtight to minimize heat losses from air infiltration. Many food products require airtight wrappers; others require greaseproof wrappers, and there is a close relation between the permeability of air and the permeability of oils. A well closed structure, not too permeable to air, is desired in cigarette paper to insure good draft through the burning tobacco. The dielectric strength of paper used in insulating electric cables is closely related to the air permeability. Certain types of bag paper require a fairly definite air permeability, since the process of filling the bags demands that the paper act as a filter to retain powdered material as the air escapes through the paper. The air permeability test is sometimes used to predict the rate of absorption of the saturant in the preparation of such materials as roofing felt, paraffined paper, sheathing paper, bakelite, and cable paper, since both properties depend upon the porosity of the untreated sheet. For the same reason air permeability is related to the rate of drying of printing ink on printing papers.

A preliminary survey indicated that the most common sources of error in existing instruments for testing the air permeability of paper are leakage, especially at the edges of the specimen, fluctuations in driving pressure, lack of sensitivity, and restricted range. The new instrument, which is described in RP681 in the May number of the Journal of Research, contains a permeability cell of novel design, in which an annular cell surrounds the inner testing cell. The air flow is so regulated that there is no lateral pressure gradient at the boundary of the inner cell, and hence no leakage into or out of it. The pressure regulator is a form of automatic diaphragm valve designed to maintain a very steady pressure drop across the instrument. The amount of air, which in a given time reaches the inner cell by flowing through the specimen under the influence of this constant pressure difference, is measured with a capillary flow meter containing four carefully calibrated capillary tubes. Results are reproducible on an identical area to within a few tenths of 1 percent. The range of the instrument is about a thousand times that of most other instruments available for the purpose. It will accommodate materials of any thickness up to one half inch, and it is not necessary to cut them in order to make the test. Tests can be made rapidly, since the element of time is taken care of in the calibration and the duration of the test need not be measured. The test area is larger than is usually found in air permeability instruments in order better to sample the material. The instrument is well adapted to the testing of leather and some other sheet materials.

EFFECT OF EXPERIMENTAL CONDITIONS ON THE MEASUREMENT OF AIR PERMEABILITY OF PAPER

With the sensitive air permeability instrument described in the preceding item, a careful study has been made to determine the effect of the various experimental conditions upon the air permeability of paper and fiber boards. The quantity of air forced through paper in this test has been found to be proportional to the duration of the test, to the pressure difference across the specimen, and to the area of the specimen, and inversely proportional to the thickness of the material. As explained in the May number of the Journal of Research (RP682), the

measurement of air permeability by this method gives results corresponding to the temperature of calibration of the flow meter, irrespective of the actual temperature of the test. The relative humidity of the atmosphere was found to affect the air permeability, but in such a way that neither the amount nor the direction of the effect can be predicted. A decrease in the absolute (barometric) pressure was found to increase the air permeability slightly, other conditions remaining constant. With the exception of the absolute pressure data, all of these results show a remarkably close agreement in behavior between the air passages in paper and long capillary tubes. Therefore, air in passing through paper probably travels a long, devious course through the labyrinthine structure of the tangled fibers.

An important use to be made of the investigation is in connection with the preparation of a standard method of measuring the air permeability of paper and fiber boards.

BOND OF MORTAR TO BRICK

The relations between some of the properties of mortars and bricks, the tensile and transverse strength, and the durability of joints in brick masonry were determined in an investigation carried out with the cooperation of organizations representing manufacturers of bricks and cementing materials. In the first phase of the investigation a survey of the physical properties of mortars was made by testing 50 different compositions, after which 15 of these were used with 6 types of brick in the construction of masonry specimens.

Twelve masonry cements, 2 portland cements, and 4 limes were used as cementing materials. Each of these was mixed in the proportion of 1 bulk volume of cementing material to 3 volumes of sand to make a single mortar composition. In addition, each of the portland cements and each of the limes were combined in 4 different ratios, and each was used as the cementing material for a mortar. This made a total of 50 different mortar compositions.

The rate of stiffening of each mortar when subjected to suction by contact with an absorptive brick was estimated. For this test, water was added to give a flow of 130 percent on a 10-inch flow table, the flow after suction on a "standard" porous base

being taken as a measure of the water retaining capacity of the mortar. (See Rate of Stiffening of Mortars on a Porous Base, Rock Products, Sept. 10, 1932.) Samples of each composition and of three consistencies (flows) were molded into bars, slabs, and cubes for use in tests for volume change, sorption, and transverse and compressive strengths. The specimens for sorption and strength tests were kept 1 week in air having a temperature of $70^{\circ} \pm 2^{\circ}$ F. and a relative humidity of 60 ± 5 percent, 3 weeks in the high humidity room of the concrete laboratory, and then in the normal air of the laboratory. Tests of one set were made at the age of 3 months. Others were stored alternately for 1 month in the high humidity room and for 3 months in the laboratory until tested when 1 year old.

The 15 mortars for the masonry specimens were selected to represent the ranges in the properties of the 50 mortars previously tested. The six types of brick were chosen to afford ranges in absorption and surface texture.

Specimens for tests of the tensile strength and durability of the bond of mortar to brick consisted of two bricks laid flatwise with a one half inch thick mortar joint between them. Some of these were aged in the same manner as the mortar specimens. Others were subjected to cycles of wetting and drying. The durability tests consisted of cycles of wetting, freezing, thawing, and drying. Specimens for tests of the transverse strength of brick masonry consisted of 5 bricks laid flatwise with 4 mortar joints to form beams. These were tested on an 11-inch span by applying loads at mid-span.

The results of the tests showed that the mortars containing slaked lime, putty, or the salts of fatty acids such as a stearate, gave the highest values of water-retaining capacity. The mortars of highest strengths were those containing portland cement. Small additions of lime to portland cement mortars increased the water-retaining capacity; the substitution of lime for a part of the cement increased the water retaining capacity and lowered the strength.

A good initial bond was obtained with all of the bricks and usually with all of the mortars, provided bricks which absorbed water rapidly were wetted before setting. The grams of water which a brick ab-

sorbed during the first minute while immersed flatwise to a depth of one eighth inch was taken as a measure of brick "suction." When the suction exceeded 60 (approximately 0.3 g/cm^2) the rapid stiffening of the mortar caused a poor bond, the area of the brick bonded being less than with wet bricks or with those of lower suction. With each mortar the joints were strongest when the suction was between 10 and 40 (approximately 0.05 to 0.2 g/cm^2). For that suction range the strength of the joint increased with an increase in the strength of the mortar. However, when the suction exceeded 60 (approximately 0.3 g/cm^2), the area of the brick bonded and the ratio of the joint strength with dry porous bricks to that with the same bricks set wet was greatest with mortars having high or medium water-retaining capacities.

Alternate wetting and drying did not cause failures of the bond of mortar to brick and there was no evidence to indicate that volume changes disrupted the bond in specimens that were initially well bonded. The effect of properties of mortars on durability of joints exposed to cycles of wetting, freezing, and thawing, and drying was determined only for specimens made with bricks which were wetted (if necessary) to have suction of 12 or less (less than 0.06 g/cm^2). Most of the joints were highly resistant to this exposure unless they were made with mortars having unusually low strengths or high sorptions.

A more complete description of the investigation is published as Research Paper 683 in the May issue of the Journal of Research.

HEAT OF HYDRATION OF PORTLAND CEMENT PASTES

The addition of water to cement results in reactions which liberate heat. The requirements of modern engineering, particularly in the case of large structures, make it important to have definite information on the amounts of heat that may be evolved and the rates of heat evolution. The total amounts of heat that are liberated from the compounds of the cement when the reaction with water is complete have been determined as a part of a cooperative research of the Portland Cement Association and the Bureau. The influence of each major compound of the cement on the rate with which the heat is liberated has likewise been studied. Examinations

have been made of the amounts of heat liberated from cement pastes, at ages from 1 hour to 6 months, using cements covering a wide range of compositions. By making use of the values of complete reaction of the cement compounds, the percentage of the available heat liberated at certain ages of test has been computed. A more complete report of this work appears as RP684 in the Journal of Research for May.

ESTABLISHMENT OF COLOR TEMPERATURE SCALE

The familiar fact that colored objects do not have the same appearance by artificial light as by daylight shows that in measurements of color, it is necessary to pay attention to the source of light. It is also a matter of common experience that when electric lights burn dimly, as a flashlight does when the batteries are nearly exhausted, the light is not only dimmer, but redder than when the batteries are new. If the voltage applied to an electric lamp is raised slowly, the filament will at first appear red, then yellow, and so on, until the color corresponding to the full voltage is reached. It is useful to have a numerical scale by which these colors can be specified, and such a scale is described as a scale of color temperature. The color of the light emitted by a tungsten lamp depends not only on the temperature of the filament, which is difficult to measure accurately, but on other factors, such as the smoothness of the surface. On the other hand, the color of the light emitted by a small hole in a furnace at uniform temperature depends only on the temperature of the furnace. The method used is therefore to operate a furnace at a uniform temperature, and then change the voltage applied to the lamp until the color of its light matches that from the furnace. The actual temperature of the furnace is then said to be the color temperature of the lamp. By color matching a lamp against a furnace at various temperatures, a relation between the voltage applied to the lamp and its color temperature is found. In this way a new and very precise scale of color temperature has been established at the Bureau and is described in RP677 in the Journal of Research for May. Advantage was taken of the fact that a metal at its freezing point (that is, the point at which the molten metal starts to so-

lidity) has a constant temperature. The "furnace" used was a very small tube (viewed through its open end) immersed in freezing metal contained in a crucible. The metals used were platinum, rhodium, and iridium, which could be used because their freezing points had previously been accurately determined. (See following item on the freezing point of rhodium.) The color of the light from a furnace or a lamp is so sensitive to changes in temperature that the color temperature of a lamp can be determined within a few degrees. The new scale differs from the scale previously in use by 14°C at the higher temperatures, and 22°C at the lower temperature. It covers the range from the color of an old-style carbon incandescent lamp, up to that of some of the brighter tungsten lamps, and provides a means for accurately specifying the chromatic properties of the light sources used in the measurement of color.

MELTING POINT OF RHODIUM

As explained in the preceding item, the brightness and color of the light coming from a small opening in a hollow inclosure maintained at a constant and uniform temperature depend only upon the temperature. A standard of luminous intensity was developed at the Bureau in 1931. This was based upon the amount of light per unit area coming from a hollow inclosure immersed in pure platinum at its freezing point, $1,773.5^{\circ}\text{C}$ ($3,224^{\circ}\text{F}$). (Technical News Bulletins No. 151 and 170, November 1929 and June 1931.) A scale of color temperature based upon the color of light coming from hollow inclosures maintained at a series of temperatures has been established to specify the color of illuminants. The very high temperatures necessary to insure a match between the color of the light and that of the lamps now used as light sources, can be most easily reproduced by using the freezing points of certain pure metals. These points must, of course, be established with great accuracy.

The metals chosen for this work were platinum, rhodium, and iridium. The freezing points of platinum and iridium have been previously determined and reported. The determination of the freezing point of rhodium proved to be more difficult than the others because this metal absorbs gases when melted in air. Later, as

the metal solidified, these absorbed gases were released violently, forming "sprouts" which broke the crucible and immersed hollow inclosure. To prevent this absorption of gases during melting the rhodium was melted and frozen in a vacuum.

The freezing temperature was determined in accordance with the International Temperature Scale and found to be $1,966^{\circ}\text{C}$ ($3,571^{\circ}\text{F}$). The complete report of this work is published as RP'676 in the May number of the Journal of Research.

COLD ROLLING OF SINGLE CRYSTALS OF COPPER

As part of a study of the effect of mechanical rolling on the hardness of copper, a number of five eighths inch round rods of oxygen-free copper were prepared in the form of single crystals. The crystalline orientation with respect to the axis of the rod was determined by etching a polished, hemispherical end of the rod. Two specimens were cold rolled, in one case the single crystal was cold rolled parallel to a cube face, in the other at an angle to the cube face and cube edges. The behavior during rolling and the hardness determinations made on the cold rolled coupons indicated that these properties are not materially affected by the orientation of the copper crystals nor by the change from ordinary, polycrystalline material to large single crystals of copper.

WEAR OF METALS

In the course of a study of the effect of surface oxide films on the metal-to-metal wear of steels, it has been found that hardened-and-tempered plain carbon steels, tested in a hydrogen atmosphere on the Amsler wear machine, show rather abrupt transition from one condition of wear which is characteristic of low tempering temperatures to a distinctly different condition of wear characteristics of higher tempering temperatures.

The wearing of specimens tempered at the lower temperatures is accompanied by the formation of surface films and the rate of wearing is relatively low; on the other hand, the wearing of specimens tempered at the higher temperatures results in a very bright, rough surface and the rate of wear is relatively very high. Tests recently completed have shown that the tempering temperature which corresponds with this change in type of

wear increases with increasing carbon content of the steel. It is close to 200° C in a 0.4 percent C steel, about 300° C in a 0.8 percent C steel, and between 400° and 500° C in a 1.3 percent C steel.

The preliminary study of this behavior has been made, for the most part, under a given set of conditions as regards the contact pressures between the specimens and the amount of "slip" between the two specimens rotating at slightly different speeds.

SIMPLIFICATION OF MILLING CUTTERS

Simplified Practice Recommendation R36-34, Milling Cutters, has been accorded the required degree of written approval by the industry and became effective April 15, 1934.

The original Simplified Practice Recommendation covering milling cutters was formulated by the industry in 1925. The current revision was proposed and developed by the industry's standing committee and effects a reduction in the number of stock sizes and varieties of milling cutters over those shown in the previous schedule.

MARKING OF GOLD FILLED AND ROLLED GOLD PLATE ARTICLES OTHER THAN WATCH CASES

The quality marks "Gold Filled" and "Rolled Gold Plate" having become, through continued competitive pressure, almost meaningless as regards intrinsic value or weight of coating, and having been depressed to the point where they provided no basis for comparison of quality on the part of the user for the reason that such coatings were being produced in weights varying from 1/10 to 1/500 of the total weight of the article, the manufacturers decided that something should be done to remedy the situation.

On March 31, 1933, a preliminary conference of the Rolled Gold Platers Association and the New England Manufacturing Jewelers' and Silversmiths Association requested the co-operation of the Bureau in establishing a standard method of marking which should provide a definite means for comparison of quality by the consumer, and a basis for fair competition among producers and distributors. It was first proposed that these quality marks should indicate minimum thicknesses of coating, but that was found to be quite impracticable, owing to the intricate shapes of many gold

covered articles, and the fact that thickness is normally computed from an overall assay of gold content and the total area of the article.

It was therefore the consensus that, with the exception of watchcases, the quality mark should indicate the ratio of the weight of the alloy coating to the total weight of the article and that the fineness of the coating should be not less than 10 karat.

The Commercial Standard as finally adopted defines the terms "Gold Filled" and "Rolled Gold Plate" which, briefly stated, signify base metal covered on one or more surfaces with gold alloy which has been rolled or drawn to the marked weight ratio before uniting with the base metal by soldering, brazing, welding, or other mechanical means. After uniting the gold alloy with the base metal alloy the duplex metal is further rolled, drawn, or otherwise worked to the desired dimensions. The standard provides that no article having an alloyed gold content of less than 1/20 shall be marked "Gold Filled"; and that the quality mark "Gold Filled" shall be accompanied by a fraction stating the correct proportion of the weight of the alloyed gold to the weight of the entire metal in the article, and by a figure stating the karat fineness of the coating; for example "1/10 12K Gold Filled", which means that the article consists of base metal covered on one or more surfaces with a gold alloy of 12 karat fineness throughout the gold covering, the said covering of gold alloy comprising 1/10 part by weight of the metal in the entire article exclusive of exemptions.

In the case of "Rolled Gold Plate", no minimum quality is specified, but it is required that the words "Rolled Gold Plate" shall always be accompanied by a fraction and a fineness designation similar to gold filled, for example, "1/30 10K Rolled Gold Plate."

The Commercial Standard also lists the exemptions regularly recognized in the trade such as screws, catches, etc.; includes the requirement that all quality marks must be accompanied by the manufacturer's name or registered trade mark as a means for determining responsibility for the quality marks; permits the use of class, pattern, or style marks; and suggests the wording of certificates and tags or other labels indicating that the item is marked in strict ac-

cordance with the commercial standard.

The pamphlet, known as Commercial Standard CS47-34, has just been released in printed form, and includes a brief history of the project, a list of the official acceptors, and the membership of the standing committee. The standard became effective for new production January 1, 1934. July 1, 1934, is the date set for clearance of existing stocks. It is interesting to note that the commercial standard has been made a part of the N.R.A. codes of fair competition for the retail jewelry trade and for the precious jewelry producing industry, on the voluntary recommendation of the industries. Copies are obtainable from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., at 5 cents each.

SUPPLEMENTARY 10,000 kc/s STANDARD FREQUENCY TRANSMISSIONS

A series of supplementary experimental radio transmissions on 10,000 kilocycles per second from the Bureau's standard frequency station WWV, Beltsville, Md., was started on Thursday, May 3, and will be continued each Thursday during May from noon to 2 p.m., eastern standard time. These transmissions are additional to the regular 5,000 kc/s transmissions and are being conducted in a similar manner.

As the object is to provide a standard-frequency service to the western half of the United States, reports are particularly desired from points more than 500 miles from Washington on how well the 10,000 kc frequency is received and as to its utility in checking frequency. The data desired are approximate field intensity, fading characteristics, and the suitability of the transmissions for frequency measurements. It is suggested that in reporting on intensities, the following designations be used where field intensity measurement apparatus is not used: (1) hardly perceptible, unreadable; (2) weak, readable now and then; (3) fairly good, readable with difficulty; (4) good, readable; (5) very good, perfectly readable. A statement as to whether fading is present or not should be included and if fading occurs, its characteristics should be described, such as time between peaks of signal intensity. The type of receiving set and type of an-

tenna used should be stated. The Bureau would also appreciate reports on the use of the transmissions for purposes of frequency measurement or control.

All reports and letters regarding the transmissions should be addressed National Bureau of Standards, Washington, D.C.

MEETING OF THE AMERICAN PHYSICAL SOCIETY

The one hundredth and ninety-first regular meeting of the American Physical Society was held in Washington, April 26, 27, and 28. The sessions on April 26 and 27 were held at the Bureau and the session on April 28 at the National Academy of Sciences. Four papers were presented by members of the Bureau's staff.

"Econodynamics", by H. C. Dickinson, in which the underlying natural laws of society as related to money, work, and the products of work were compared with those of thermodynamics. The close similarity between these laws was explained and demonstrated by a mechanical model called the "economy demonstrator."

"Is the sound absorption coefficient of a material a constant or a variable?", by V. L. Chrisler, in which it was shown that using the usual formula for the rate of decay of sound energy, and basing the values of the sound absorption coefficients on the measured reverberation times, the coefficient of any given material is not a constant, but varies with the area of the sample.

"The change of the vapor pressures of the hydrogen isotopes with time", by R. B. Scott and F. G. Brickwedde of the national Bureau of Standards, and H. C. Urey and M. H. Wahl of Columbia University. The changes in the vapor pressures of protium and deuterium condensed in glass capsules immersed in liquid hydrogen were measured with mercury manometers. An increase in the vapor pressure of protium, and a slight decrease in the vapor pressure of deuterium were observed. From the data it appears that deuterium is more suitable than protium for fixed points in thermometry.

"Ionization of liquid carbon disulfide by X-rays", by F. L. Mohler and L. S. Taylor. The ionization current produced by X-rays in an ionization chamber containing an insulating liquid has the characteristics found in gases at high pressure.

NEW AND REVISED PUBLICATIONS ISSUED DURING APRIL 1934

Journal of Research¹

Bureau of Standards Journal of Research, vol. 12, no. 4, April 1934 (RP No. 666 to 675, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers¹

(Reprints from January and February 1934 Bureau of Standards Journal of Research)

NOTICE.—Beginning with the July 1934 issue of this Journal the prices of the separate Research Papers appearing in each issue will be given on the front cover of the Journal.

This new arrangement provides a prompt and convenient method whereby readers desiring copies of separate Research Papers appearing therein may send their orders immediately to the Superintendent of Documents, United States Government Printing Office, Washington, D.C., and will aid him in determining the number of copies to be printed. The type is not held and there is but one edition.

RP632. Studies of the ionosphere and their application to radio transmission; S. S. Kirby, L. V. Berkner, and D. M. Stuart. Price, 5 cents.

RP638. Soil-corrosion studies. 1932. Rates of loss of weight and pitting of ferrous and nonferrous specimens and metallic protective coatings; K. H. Logan and R. H. Taylor. Price, 5 cents.

RP643. A critical test for the purity of gases; M. Shepherd. Price, 5 cents.

RP644. Flow in roof gutters; K. Hilding Beij. Price, 5 cents.

RP645. Olivine as a refractory; R. A. Heindl and W. L. Pendergast. Price, 5 cents.

RP651. A fractionating column with fritted glass plates; S. T. Schick-tanz. Price, 5 cents.

Handbooks¹

H18. Radium protection for amounts up to 300 milligrams. Price, 5 cents.

Technical News Bulletin¹

Technical News Bulletin No. 204, April 1934. Price 5 cents. Obtainable by subscription

¹ Send orders for publications under this heading only to the Superintendent of Documents, United States Government Printing Office, Washington, D.C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, \$2.50 per year (United States and its possessions; Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and \$3.25, respectively.

Letter Circulars

It is the intent of the Bureau to distribute single copies of these Letter Circulars on request only to those parties having special interest in the individual Letter Circular. Economy necessitates limitation in the number of copies issued. It is not the intent to supply parties with a copy of each Letter Circular issued during the month. Letter Circulars are necessarily of a temporary nature designed to answer numerous inquiries on a given subject. Requests should be addressed to the National Bureau of Standards.

LC406. Theatre safety curtains. (Replaces LC137.)

LC408. Automobile engine graphited lubricants. (Replaces LC387.)

LC409. Specification for proving rings for calibrating testing machines. (Replaces LC294.)

LC410. Simplified practice—Its purpose and application.

LC411. Rubber cements.

LC412. Domestic electric and gas refrigerators. (Replaces LC297.)

Outside publications²

George, W. D., The testing of frequency monitors for the Federal Radio Commission, Proceedings of the Institute of Radio Engineers (33 West 39th St., New York, N.Y.), p. 449, April 1934.

Souder, Wilmer, Safe use of scientific methods, Transactions, International Association of Chiefs of Police (Chief of Police, Wilmington, Del.), p. 276, 1933.

Ingberg, S. H. Methods for calculating the volumetric composition of fluid mixtures, Physics (American Institute of Physics, 11 East 38th St., New York, N.Y.), vol. 5, no. 3, p. 64, March 1934.

Coblentz, W. W., Tinted lenses—the present deal, Journal, American Medical Association (535 North Dearborn St., Chicago, Ill.), vol. 102, p. 1223, April 14, 1934.

Taylor, L. S. Report of committee on standardization of X-ray measurements, Radiology (Medical Arts Building, Syracuse, N.Y.), vol. 27, p. 289, March 1934.

Taylor L. S., Singer, G., and Stoneburner, C. F., Comparison of high voltage Roentgen ray tubes, American Journal of Roentgenology (110 Professional Building, Detroit, Mich.), vol. 31, p. 378, March 1934.

Thompson, J. G., Methods for determining oxygen in steel—A progress report. Mining and Metallurgy (29 West 39th St., New York, N.Y.), vol. 15, p. 215, May 1934.

² "Outside publications" are not for sale by the Government. Requests should be sent direct to publishers.

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